

## **National Incidence of Waterborne Disease Attributable to Drinking Water: A Bayesian Approach Based on the Davenport Household Intervention Study**

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The 1996 amendments to the Safe Drinking Water Act included a provision that the U.S. Environmental Protection Agency (U.S. EPA) and the Centers for Disease Control and Prevention (CDC) conduct studies on waterborne disease occurrence in five U.S. communities and estimate the national occurrence of waterborne disease. The U.S. EPA and CDC conducted meetings with experts and stakeholders to discuss epidemiology study designs and approaches to developing the national estimate. The first of the major full-scale drinking water epidemiology studies in the U.S., a 12-month blinded household intervention in Davenport, IA, to determine the fraction of gastrointestinal (GI) illness attributable to drinking water, is now in press. The study was an example of collaboration between the U.S. EPA's research labs, its Office of Ground Water and Drinking Water, and the CDC's National Center for Infectious Disease. A study of drinking water quality conducted at the same time as the epidemiology study was a U.S. EPA collaboration with the American Water Works Research Association and the American Water Company. The results of both studies have informed this Bayesian analysis of waterborne disease occurrence in the US.

This poster first describes how prior knowledge of the U.S. EPA team members was elicited and encoded. The team's prior beliefs about Davenport's Attributable Incidence (AI) was modeled as a piecewise uniform distribution. Next, the team's beliefs about Davenport's placement in the U.S. distribution of AI were modeled, conditional on Davenport's true AI. A logit-linear regression was used to model the relationship between the team's upper credible band for placement and Davenport's AI. Another logit-linear function was used to model the team's lower credible band.

Next, the poster describes new information obtained from the Davenport household intervention study. A joint posterior distribution for Davenport's AI and placement was derived using Bayesian methods. Marginal posteriors illustrate how the new information led the team to understand that Davenport's AI and placement are both somewhat less than expected.

Finally, the poster describes how posterior information on Davenport was used to define the national distribution of AI. The credible interval about the resulting national estimate (average national attributable incidence rate) reveals considerable uncertainty due to (1) imprecision of

Davenport's attributable incidence rate, (2) uncertainty about Davenport's placement in the national distribution, and (3) uncertainty about the national distribution's variance.